



MAINE DEPARTMENT OF
Energy Resources

**Transmission Planning
Stakeholder Group Meeting #5
Pursuant to Resolve 2025, ch. 57**

June 2, 2026

Resolve 2025, ch. 57

To Direct the Governor's Energy Office (now DOER) to Conduct a Study Regarding the Future of Electric Transmission Infrastructure in the State



DOER will **coordinate with state agencies** involved in the siting, permitting and regulation of electric transmission infrastructure and **solicit information from a stakeholder group** to assist in conducting the study under section 1.



DOER must submit a report with an overview of the study and any recommendations **to the Legislature by September 1, 2026.**



DOER will **include any comments provided by the stakeholder group as an appendix** to the report of the study.



Maine Transmission Infrastructure Study

Pursuant to the legislation, the study must include a review of:

1. Existing processes for the siting and permitting of new and upgraded electric transmission infrastructure in the State;
2. Best practices related to electric transmission planning, siting, permitting and community engagement from other states or regions;
3. Existing analyses of future electric transmission needs in the State necessary to integrate new renewable resources as well as to ensure reliability, improve market efficiency or support the achievement of the State's policy goals;
- 4. *Types of existing rights-of-way and opportunities for potential use of those rights of-way for siting of electric transmission infrastructure in the State; and***
- 5. *Existing and emerging technology and construction methods...including strategic undergrounding and a cost-benefit analysis comparing buried high-voltage direct current lines with aerial high voltage alternating current lines and aerial high-voltage direct current lines.***



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Next Steps for Engagement

- DOER will conduct one more stakeholder group meeting prior to the submission of the report.
 - **August 5, 2026, 2pm-4pm:** Overview of the draft Maine Instructure Study and how its content evolved based on stakeholder input
- Please submit final thoughts and responses – to be incorporated into the draft report - to DOER **by June 16th, 2026.**
- The study will be completed and submitted to the Legislature by September 1, 2026.



Today's Goals

- Explore **existing rights-of-way and opportunities for potential use** of those rights of-way for siting of electric transmission infrastructure in the State; discuss **strategic undergrounding** and compare buried high-voltage direct current lines with aerial high voltage alternating current lines and aerial high-voltage direct current lines.
- Discuss these opportunities, generating **feedback and input** for the Maine Transmission Infrastructure Study.
- Review the Transmission Stakeholder Group's engagement and work to date



Today's Agenda

- **Brief re-introductions and opening exercise**
- **Presentation by The Ray and E3 with opportunity for discussion**
- **Facilitated Q&A and time for public input**
- **Next steps for engagement**



Use of Existing Rights-of-Way for Transmission Colocation

Assessment of Colocation in Roadway and Railway Right-of-Way From a National, Maine, and Other States Perspective

June 2, 2026

Overview of Presentation

Objective: Examine policy, infrastructure, and operational considerations for transmission colocation in roadway and railway ROWs.

Methodology

Identify and analyze key Federal regulations, state statutes and codes, recent legislation, utility accommodation policies, railroad documentation, FHWA guidance and reports, other relevant policies or best practices

Presentation Topics

- What is Transportation ROW Colocation?
- Evaluation of Applicable Regulatory Processes
- Evaluation of Technical Design Considerations
- Evaluation of Permitting Methodologies
- Evaluation of Safety Considerations
- Evaluation of Utility Relocation Costs
- Coordination Required for ROW Colocation
- Possible Strategies for Maine



Badger Coulee Line (Source: American Transmission Company)

What is Transportation ROW Colocation?

Transportation ROW colocation is the siting of transmission lines (by utilities or transmission developers) within **roadway or railway ROW**.

Siting in these corridors makes use of **previously disturbed land**, minimizing the need to procure new land or develop greenfield or disturb scenic views.

Successful colocation of transmission requires navigating a variety of factors, such as complex operational and financial trade-offs.



Key Considerations for Transportation ROW Colocation

Pre-Planning Considerations

- Infrastructure and Environmental Factors
- Future Transportation Plans
- Existing Transportation and Transmission Assets
- Underground vs. Overhead
- Conflicting and complex public and private interests

Financial Considerations

- Easement costs vs. Colocation fees for Utilities
- Negotiations with multiple land-owners vs. DOT/Railroad
- Revenue for DOT vs. Exclusive DOT ROW use
- Reduced Maintenance Costs for DOTs

Non-Monetary Considerations

- Reduced impact to greenfield sites
- Viewshed impacts



National Perspective

Project Name	State(s)	Voltage Type		Construction Type			ROW Type			Status as of June 2025			Length
		AC	HVDC	Over	Under	Both	Road	Rail	Both	Commissioned	NEPA Approved	Proposed	Miles
AV Solar Ranch One Project	CA												4
Lacombe to Barket	CO												1
SOO Green HVDC Link	IA-IL												350
Dodge County Wind Project Transmission Line	MN												27
Mankato-Mississippi River Transmission Project	MN												140
Williston to Stateline Transmission Line Project	ND												16
Champlain Hudson Power Express	NY												336
South Fork Wind	NY												4
Amtrak Zoo to Paoli Electric Transmission Line	PA												18
Big Cottonwood Canyon Wildfire Mitigation	UT												35
Haymarket Transmission Project	VA												5
New England Clean Power Link	VT												154
Badger Coulee 345 kV Transmission Line Project	WI												180
Dodge County Distribution Interconnection Project	WI												15
Rockdale to West Middleton Transmission Project	WI												32
Cardinal-Hickory Creek 345-kV Transmission Line	WI-IA												102

Total	10	3	8	7	1	12	2	2	6	4	6	1419
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Appendix A - Transmission Projects Located Longitudinally in the Transportation Right-of-Way (Source: Pacific Northwest National Laboratory). *Terminated projects removed.*

Transportation ROW in Maine

**National
Highway System**

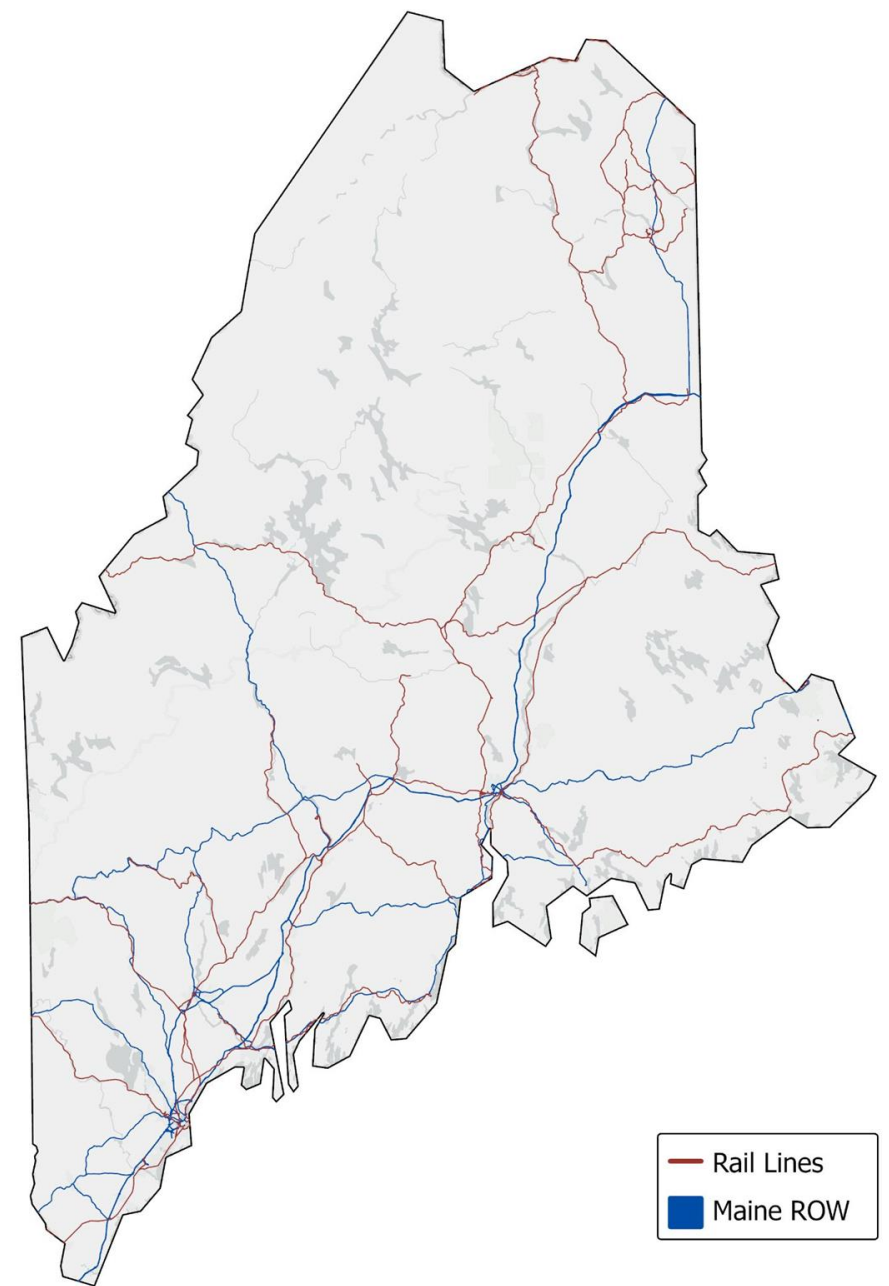
1315 miles⁴⁴

Class I Railroads

732 miles⁴⁵

**Class III
Railroads**

231 miles⁴⁵



Evaluation of Applicable Regulatory Processes (1/2)

Key takeaway: Regulatory and policy frameworks exist for transmission colocation in transportation ROWs on a case-by-case basis.

Roadway	National	Other States	Maine
	• 23 CFR Part 645 and FHWA guidance permits transmission lines within Federal-aid highway projects, assuming the occupancy is consistent with safety and aesthetic requirements.^{1,2}	• Some states allow longitudinal transmission within freeway ROW if there are no adverse impacts to freeway operations and non-freeway corridors are unavailable.³ • Some states dictate that highway and railroad corridors should be considered second when siting new transmission lines.⁴	• Maine regulations generally prohibit longitudinal transmission within Freeway Controlled Access (COA) corridors. • Exceptions may be made where the preservation of highway safety, the protection of future expansion capacity, the absence of cost-effective alternatives, and a definitive showing of "substantial public interest" can be demonstrated.^{5,6}

Evaluation of Applicable Regulatory Processes (2/2)

Key takeaway: While Maine statutes permit railroad colocation, specific requirements for colocation are left to the discretion of the individual Railroads.

Railway	National	Maine
	Some states dictate that highway and railroad corridors should be considered second when siting new transmission lines.⁴	35-A MRS §2311 authorizes transmission colocation within railroad ROW.⁷ Individual Railroads operating within Maine set their own design requirements and permit structures. - Railroads emphasize that the primary purpose of both Railroad's ROW is to operate a railroad. Any utility occupancy must not interfere with, interrupt, or endanger rail operations.^{8, 9} - Railroads often outline clear steps for utilities to obtain a Utility Occupancy License.^{10, 11} Utilities must communicate directly individual Railroads.

Evaluation of Select Technical Design Considerations (1/2)

Key takeaway: Technical design requirements vary widely but can be constructed to meet specific colocation requirements such as future relocation, impacts to scenic areas, safety, and roadway operations.

Roadway	National	Other States	Maine
	• 23 CFR Part 645 prohibits new utility installations on highway ROWs that have used Federal-aid or direct Federal highway funds that have aesthetic implications for areas of “scenic enhancement and natural beauty.”¹	• Wisconsin requires that transmission facilities are located “in such a way that minimizes the need for future adjustment for things like proposed highway improvements.”¹²	• For above-ground installations, Maine requires lines be situated as close to the ROW boundary as possible to maximize horizontal clearance.⁶

Evaluation of Select Technical Design Considerations (2/2)

Key takeaway: Technical design considerations can be outlined at the state-level or be left to individual Railroads to determine.

Railway	Other States	Maine
	- California Public Utilities Commission has issued General Orders that set requirements for aboveground and underground longitudinal transmission installations within railroad ROW.^{13, 14, 15} - Texas Administrative Code outlines requirements for clearances, distances, depth, casing, and inductive inference studies.¹⁶	- While Railroads follow industry-standard engineering guidelines, the specific technical requirements for colocation are set by individual carriers. Utilities must consult the design manuals for an individual railroad to confirm required safety offsets for above-ground poles and the structural casing standards for underground lines. - CSXT requires an inductive interference coordination study for all longitudinal aerial transmission lines.⁹

Evaluation of Permitting Methodologies (1/2)

Key takeaway: Alternative permitting frameworks are associated with compressed project timelines.

	National	Other States	Maine
Roadway	Federal regulations make certain Categorical Exclusion environmental review exemptions for transmission projects colocated in transportation ROW.^{17, 18, 19}	- The Rhode Island Energy Facility Siting Board consolidates the requirements of various state departments into a single, cohesive review.^{20, 21} - Minnesota's approach allows simultaneous coordination rather than sequential approval of environmental reviews and applications.^{21, 22, 23} - Wisconsin DOT requires early coordination with utilities and a Constructability Report prior to issuing a permit.²⁴	- Utilities are required to secure a Certificate of Public Convenience and Necessity from the Maine PUC.²⁵ - Maine DEP reviews projects to ensure they have a "minimal adverse impact".²⁶ Colocated transmission projects face the same analysis as greenfield projects. - The Natural Resources Protection Act does not include an exemption for colocated transmission lines.²⁷ - MaineDOT Permits are the same for transmission, distribution and communication lines.⁶

Evaluation of Permitting Methodologies (2/2)

Key takeaway: Permitting for railway colocation is dependent on individual Railroads.

Railway	National	Maine
	• 49 CFR 264.101 directs FRA-funded rail projects to comply with Federal compliance rules as outlined for FHWA and FTA.²⁸	• Utilities must work with individual Railroads when proposing a project. Each Railroad's permitting structure must be consulted. • Examples of occupancy permits from different Railroads include Longitudinal Occupancy Permits, Utility License Agreements, Utility Occupancy Licenses, and Utility Occupancy License Agreements.^{29, 8, 10, 11} • Some Railroads require agreements such as Right of Entry (ROE) or Contractor Occupancy/Access.¹⁰

Evaluation of Safety Considerations (1/2)

Key takeaway: Safety requirements can be made as stringent as desired. Where facilities are located and what existing safety infrastructure is in place matter.

	National	Other States	Maine
Roadway	• The US Code and Code of Federal Regulations dictates safety requirements for ROW colocation. ○ The safety of the traveling public is non-negotiable for any transmission project approval.³⁰ ○ While safety is “paramount,” it is not of “sole importance” when colocating utilities in ROWs, as utilities “provide an essential public service.”³¹ ○ Above-ground installations should be sited along the ROW line. New installations should not be located within the clear zone.³² ○ States must address safety issues posed by accident history or safety studies.³³	• Wisconsin requires that above-ground installations be located outside of the clear zone.¹²	• For above-ground installations, Maine specifies the required horizontal clearance for poles from guardrails in the Appendix of the Utility Accommodation Rules.⁶

Evaluation of Safety Considerations (2/2)

Key takeaway: Use of specific technologies and mitigation strategies can minimize safety impacts within railway corridors.

Railway	Other States	Maine
	The S00 Green HVDC Link in Iowa and Illinois utilizes undergrounded bi-directional DC technology, eliminating the induced currents common in AC systems and canceling out magnetic fields, significantly reducing electrical and magnetic interference within rail and roadway corridors.³⁴	Safety guidelines and requirements vary by Railroad. - Railroads state that activities in their ROW must not adversely affect the operation of the Railroad or the integrity of their facilities.^{9, 35} - CSXT requires an inductive interference coordination study for all longitudinal aerial transmission lines. - Railroads refer to internal or national engineering standards for safety.³⁶

Evaluation of Utility Relocation Costs (1/2)

Key takeaway: Early coordination and planning to colocate transmission away from areas where future roadway projects are planned reduces financial costs and risks for DOTs and transmission developers.

Roadway	National	Other States	Maine
	• Under 23 U.S.C. § 123 and 23 CFR Part 645, federal funds may reimburse utility relocation costs necessitated by transportation projects. ○ However, FHWA literature stresses that states should avoid relocations whenever possible to minimize the burden on taxpayers.^{37, 1, 38}	• Minnesota Statutes Section 161.45 requires a four year notice for relocation. • If less than four years is given, the DOT must pay for 75% of the relocation costs. • Similar language has been introduced in other states, such as in Illinois.^{39, 40, 41, 42}	• Transportation funds are strictly prohibited from being used for utility relocation, meaning utilities are responsible for all relocation costs.⁶

Evaluation of Utility Relocation Costs (2/2)

Key takeaway: Determining the party responsible for utility relocation costs depends on individual agreements with Railroads.

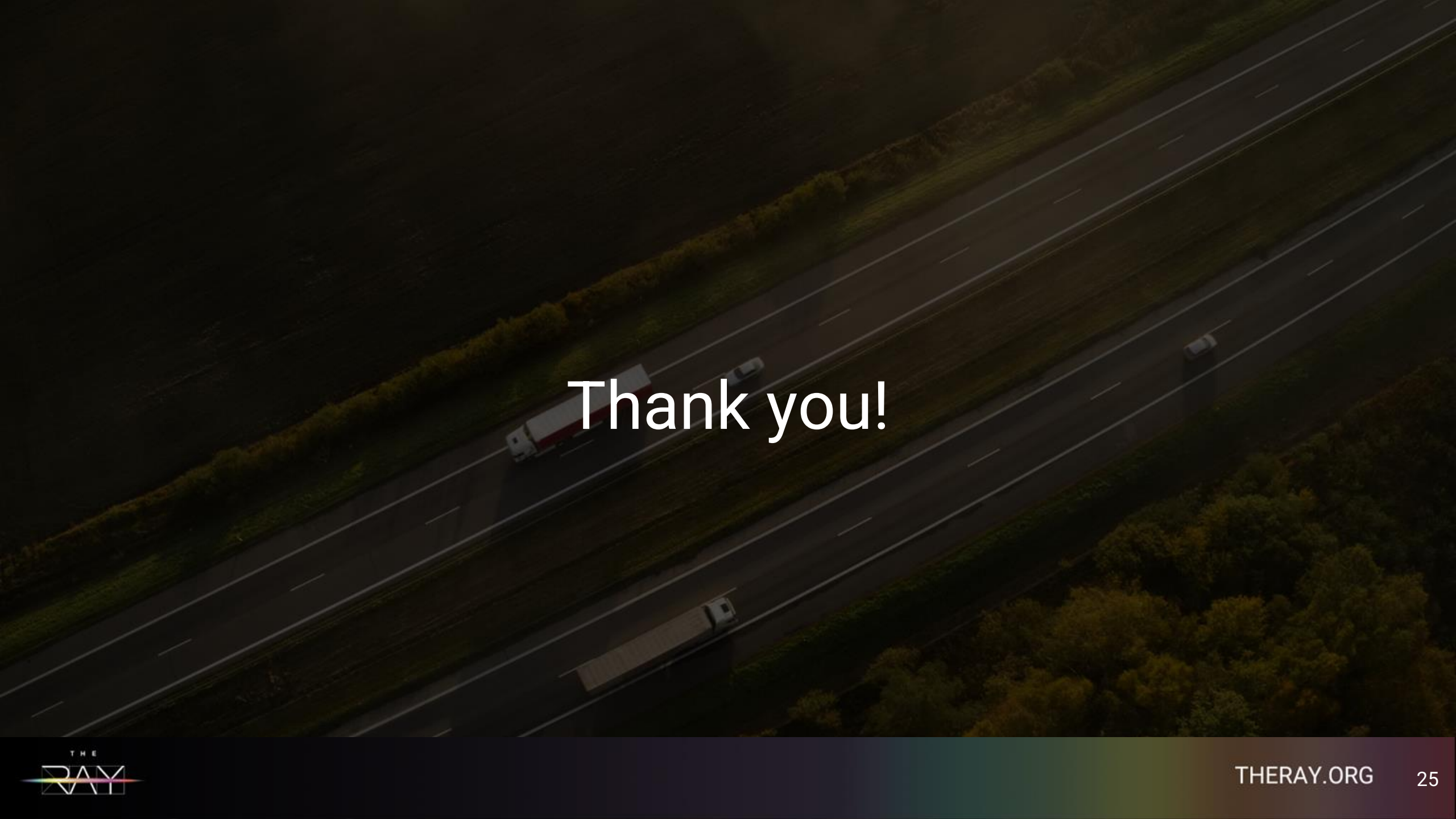
Railway	Other States	Maine
	• “SOO Green agreed to pay the cost of relocating the transmission line, if necessary.” ○ SOO Green decided to pay a fee to occupy both rail and road ROW, instead of seeking an easement. “To mitigate their own risk, SOO Green selected ROW segments that are less likely to be expanded or relocated.” ³⁴	• There is no explicit Maine statute governing utility relocation costs if a transmission line must be relocated from railroad ROW. • While 35-A MRS §2311 gives MPUC authority to resolve disputes between utilities and Railroads, utility relocation cost responsibility is outlined in individual agreements between Railroads and utilities.⁴³

Recap

- **Colocation and Requirements:** The implementation of case-specific technical criteria determines the feasibility of siting transmission facilities within ROWs.
- **Safety Standards:** Safety requirements can be set to any desired stringency, influenced by facility location and existing safety infrastructure.
- **Utility Relocation Costs:** Early-stage planning correlates with the need for future relocation, reducing costs for DOTs, transmission utilities and the consumer.
- **Technical Design:** Technical design standards mitigate future relocation requirements and manage impacts on scenic corridors, road safety, and roadway operations
- **Permitting:** Alternative permitting frameworks are associated with compressed project timelines.

Possible Strategies for Future Consideration

Strategy	Description
Utilize and Partner with Existing Infrastructure	Partnering with fiber companies to colocate transmission along their existing infrastructure within transportation ROW
ROW Occupancy Fees	DOT charges transmission infrastructure a fee to colocate within DOT-owned ROW
Safety Infrastructure	Transmission developers pay to install guardrails in front of new transmission poles as required by a state's UAP
Geospatial Analysis of ROW for Colocation	Assesses aboveground and underground suitability of and constraints for within roadway and railroad ROW
Vegetation Management	Transmission line owner pays for the cost of maintaining vegetation within colocated ROW
Colocation Planning Working Groups	A dedicated group with relevant stakeholders to propose colocation planning satisfactory to state agencies and private companies
Horizontal Blowout Accommodation	Uses edge of transportation ROW to accommodate half of horizontal clearance for wind-induced blowout
Categorical Exclusions	An exemption from environmental permitting requirements for transmission colocated in transportation ROW
Constructability Reports	Requires a utility or developer to submit a Constructability Report before the DOT issues a permit
Hire expert employees from other industries	Hire industry experts (often former employees) that have the expertise needed for complex conversations
State Agency Cooperative Agreements	The DOT and PUC enter into a formal agreement to ensure coordination between the two agencies and align priorities



Thank you!

Q&A and Discussion Guidelines

- **This is a meeting of the Stakeholder Group**
 - *We'll take questions and comments from observers if there is time*
- **It's OK to bring different perspectives**
 - *Show others the respect you'd want people to show you*
- **Please be brief**
 - *Share the space with others and send any additional feedback via email (doer@maine.gov)*
- **Please stay on topic**

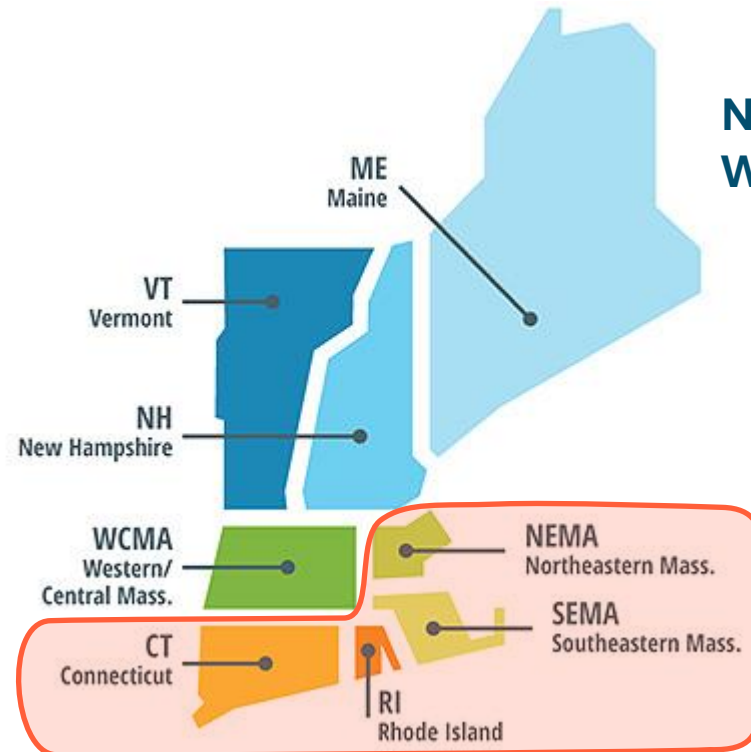


Agenda: Strategic Undergrounding

- + Historical Examples of Undergrounding (Slides 2-3)
- + Strategic Undergrounding (Slide 4)
- + Barriers and Benefits of Undergrounding Transmission (Slides 5-11)
- + Strategic Undergrounding Applications (Slides 12-13)

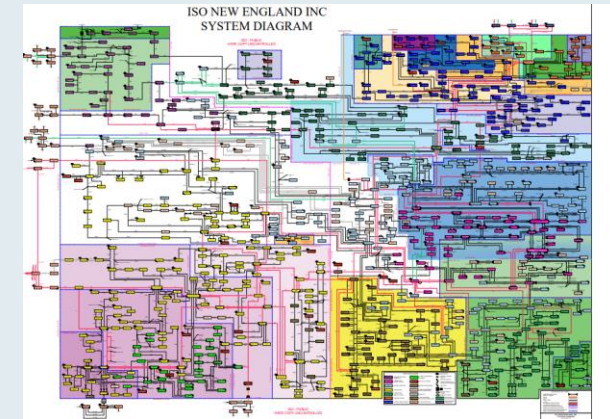
Older underground transmission is located in dense urban areas

- + Most existing underground transmission in New England is in cities
- + Located in dense urban areas where overhead transmission is infeasible
- + These projects were mainly built 30+ years ago



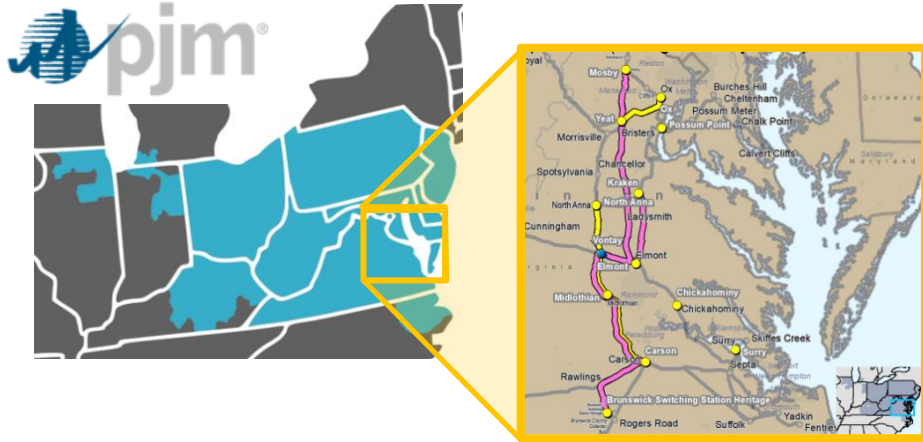
**New England
Wholesale Load Zones**

Most underground
transmission in
these zones



[ISO-NE System Diagram](#) contains detailed information on every line in New England

In recent history, undergrounding has been used as a tool for addressing concerns around visual impacts



Heritage to Mosby Transmission Line (PJM)

- **\$4.8 Billion underground 185-mile HVDC line**
- Meets growing loads in Northern VA's dense suburban areas in part due to data center growth
- County board of supervisors sent letter of support for the project that avoids visual and environmental impacts from overhead transmission
- Approved by PJM and set for cost allocation despite some estimates that it **costs twice as much as overhead alternatives**

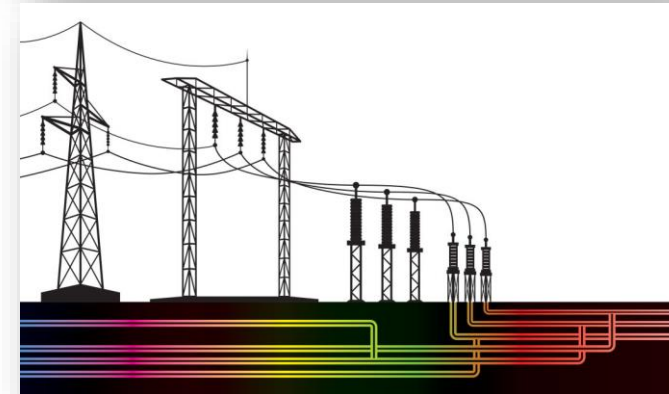


Tehachapi Renewable Transmission Project (CAISO)

- **3.5 miles of the 173-mile transmission project is undergrounded**
- Project supplies large amounts of renewables to load centers in Southern CA
- Underground section proposed in response to significant concern about the overhead line's impact in residential and recreation areas
- 3.5 mile underground section cost **\$224 M while the original overhead estimate was \$4 M for the same segment**

Undergrounding may be used as a strategic tool for identifying specific opportunities for added benefits

- + As the need for new transmission grows, opportunities exist to find solutions where undergrounding may be effective
- + Studies have found that **broad use of undergrounding transmission everywhere is too costly**, but targeted use cases may be beneficial
- + **Strategic undergrounding** means targeting specific conditions in which undergrounding can provide net benefits



Top: [Underground Infrastructure](#)
Bottom: [Portland Monthly](#)

Benefits and barriers of strategic undergrounding

Compared to standard overhead transmission lines, undergrounding carries a range of both benefits and barriers

- + **Reduced long-term visual and environmental impacts; eliminates towers and overhead lines**
 - Can ease permitting challenges especially in dense areas
- + **Lower exposure to weather, including wind, ice, and falling trees, which can reduce outage frequency**
- + **Wildfire risk reduction by removing ignition sources associated with overhead lines**
- + **Can utilize narrower rights-of-way; may enable better use of transportation corridors**

Benefits

Barriers

- + **Much higher costs, can be 5x-10x+ the cost of overhead lines**
 - This is commonly the biggest limiting factor
- + **Repairs, when needed, are slower and costlier; faults can be difficult to find**
- + **Installation is slow and can be disruptive to communities and environments during installation**
- + **Thermal limitations can lead to capacity derates (for AC lines)**
- + **Converter stations contribute to even higher costs (DC lines)**

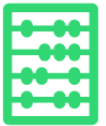
Benefits: reduced visual impacts

Undergrounding eliminates towers and overhead lines, reducing visual impairments



Benefits include

- Preserves or improves aesthetic value which can impact
 - Property values
 - Tourism
 - Community value
- May ease permitting challenges in cases with local concern



Quantification methods include

- Quantifying property value impacts by comparing real estate prices
 - LBNL study found towers and overhead transmission can reduce property values 5%-20%
- Studies into willingness-to-pay and tourism impacts
- Qualitative studies estimating community value



Top: [Plisga & Day Land Surveyors](#)
Bottom: [Utility Dive](#)

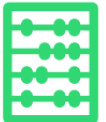
Benefits: lower exposure to certain environmental hazards

Undergrounding provides protection from and higher resilience to environmental risks



Benefits include

- Avoiding outages due to
 - Wildfire
 - Extreme weather (high winds, heavy snow, fallen trees)
- Improves resiliency and economic efficiency
- *Note: undergrounding may not entirely remove outage risk*



Quantification methods include

- Production cost and power flow simulations of extreme weather events to capture
 - Reductions in outages and loss of load
 - Avoided transmission congestion
- Reduced costs to service damaged lines



Top: [Maine Public](#)

Bottom: [Stanford Woods Institute for the Environment](#)

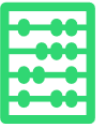
Benefits: utilization of narrow ROW

Undergrounding can reduce ROW by eliminating large clearances, tower spacing, and vegetation management buffers required for overhead lines



Benefits include

- Reduced land disturbance and vegetation clearing
- Lower habitat fragmentation
- Can reduce barriers in urban areas where an overhead line cannot be installed with appropriate clearances



Quantification methods include

- Reduced ROW acquisition costs
- Reduced costs due to improved siting efficiency from avoiding ROW constraints
- Reduced vegetation O&M costs

ROW easement required for typical 345 kV transmission lines	
Overhead	Underground
120-200 feet	40-60 feet



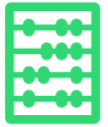
Barriers: higher capital costs

Undergrounding requires complex installation and maintenance which can increase costs



Barriers include

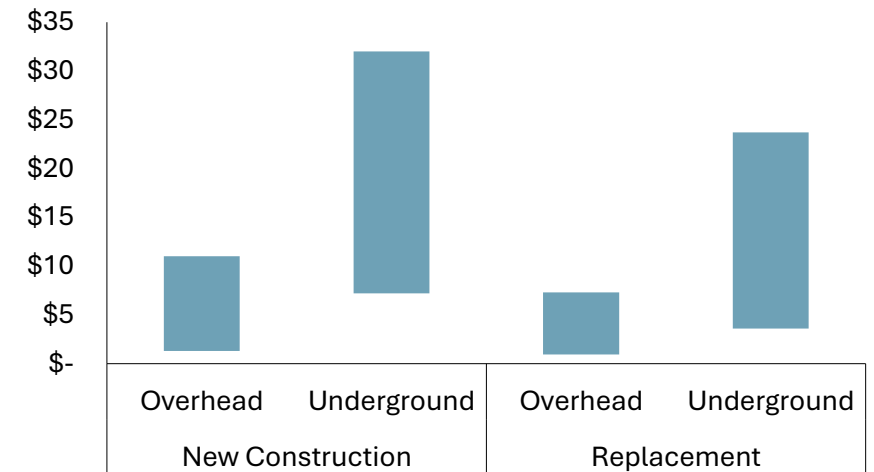
- Requires extensive excavation
- Requires thermal management and insulation



Quantification considerations include

- Estimating capital costs can vary widely based on:
 - Rural, suburban, or urban regions
 - Voltage levels
 - Geologic conditions
 - New construction vs retrofit
 - HVAC vs HVDC

Range of Capital Costs (\$M/mile)



**Cost figures estimated by New York utilities for 2023 study called [The Benefits, Costs, and Economic Impacts of Undergrounding New York Electric Grid](#)*

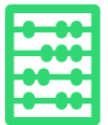
Barriers: high operations and maintenance costs

Underground environmental conditions cause new risks and repairs can be slow and costly



Barriers include

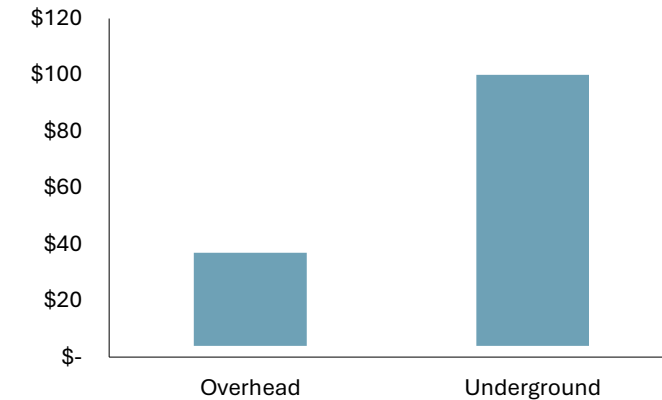
- High complexity in locating and repairing faults on the line result in slower and higher-cost repairs
 - Requires excavation to locate and repair faults
 - Repair time for a fault can take between two-six weeks for underground lines versus hours to days for overhead lines
- Less adaptable to terrain changes, high impact to soils and surrounding ground
 - Risk of moisture damage
 - Possible impacts on groundwater flow
 - No trees are allowed to grow over line to allow access for repair



Quantification considerations include

- Estimating O&M for transmission lines ranging from \$4k-\$100k/mile

Range of O&M Costs (\$000/mile)



Garage-sized concrete access structures must be placed underground every 1,500 to 2,500 feet for maintenance and repair of an underground line



Barriers: electrical and thermal limitations

When utilities evaluate electrical, thermal, geotechnical considerations when assessing undergrounding, they may come across electrical and thermal limitations



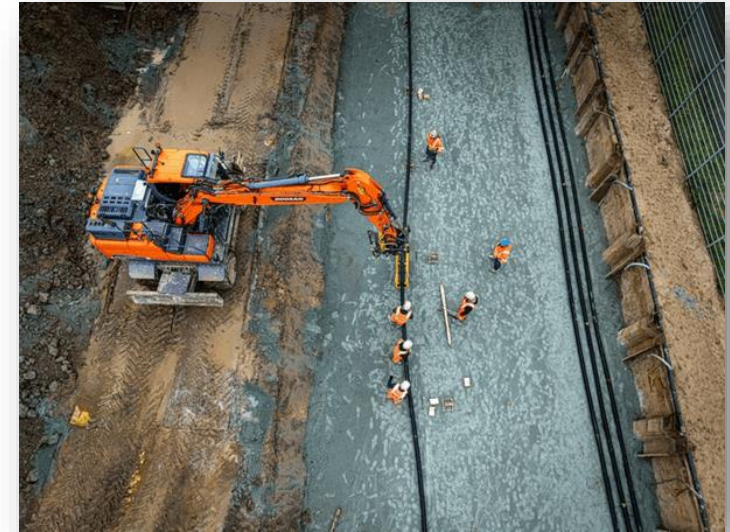
Barriers include

- Undergrounding creates capacitance challenges to AC lines
 - Over 50-100 miles becomes necessary to use DC over AC technology
- Certain soil and geologic conditions may poorly dissipate heat from transmission lines, requiring thermal backfill or derating



Quantification considerations include

- Line length and HVAC vs HVDC configuration
- Soil thermal conductivity and moisture conditions
- Cost of thermal backfill



Source: [Bontrup](#)

Enabling Conditions for Strategic Undergrounding



High aesthetic values

High property value impacts and perceived benefits from avoided visual impacts



Favorable right-of-way

ROW is impractical for overhead route, or significantly shorter for underground route



Higher density areas

More customers benefit per mile



Favorable geology

Easier trenching and installation



Adequate thermal conditions

Underground cables need heat dissipation, or adequate need for DC transmission



High environmental hazard exposure

Benefits increase when outages from wildfire and extreme weather are frequent or severe



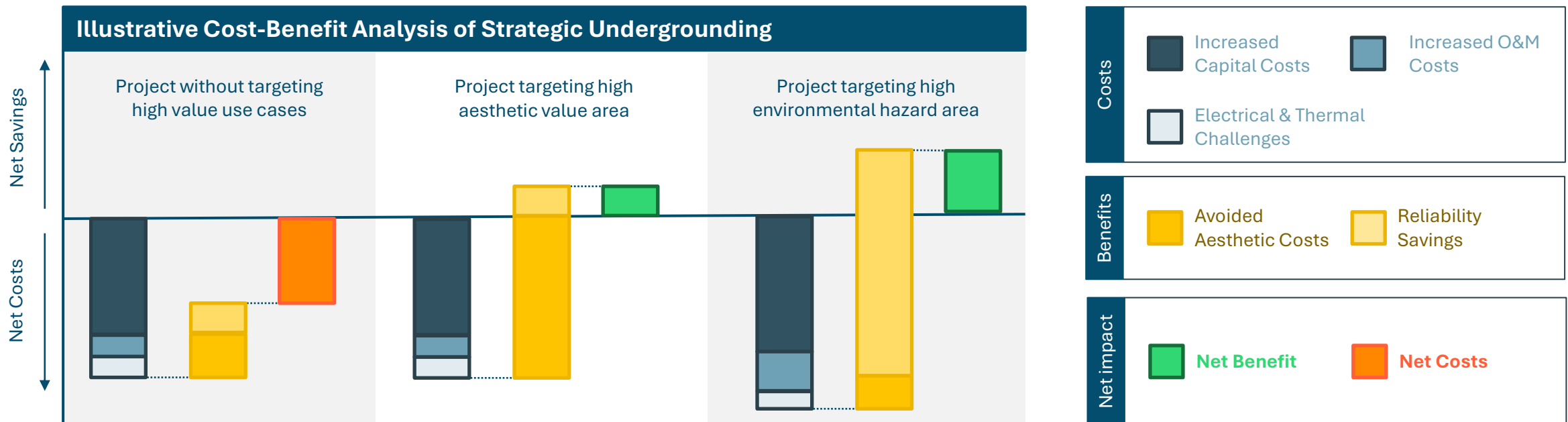
Costly outage consequences

Hospitals, police and fire stations, and other critical loads

Illustrative Steps Towards Identifying Opportunities for Strategic Undergrounding

+ Cost-benefit analysis can help identify Strategic Undergrounding projects

- Identify potential opportunities for undergrounding
- Quantify the lifecycle costs of undergrounding relative to overhead
- Identify undergrounding benefits relevant to Maine ratepayers
- Workshop methods for measuring benefits
- Identify opportunities with highest net benefits

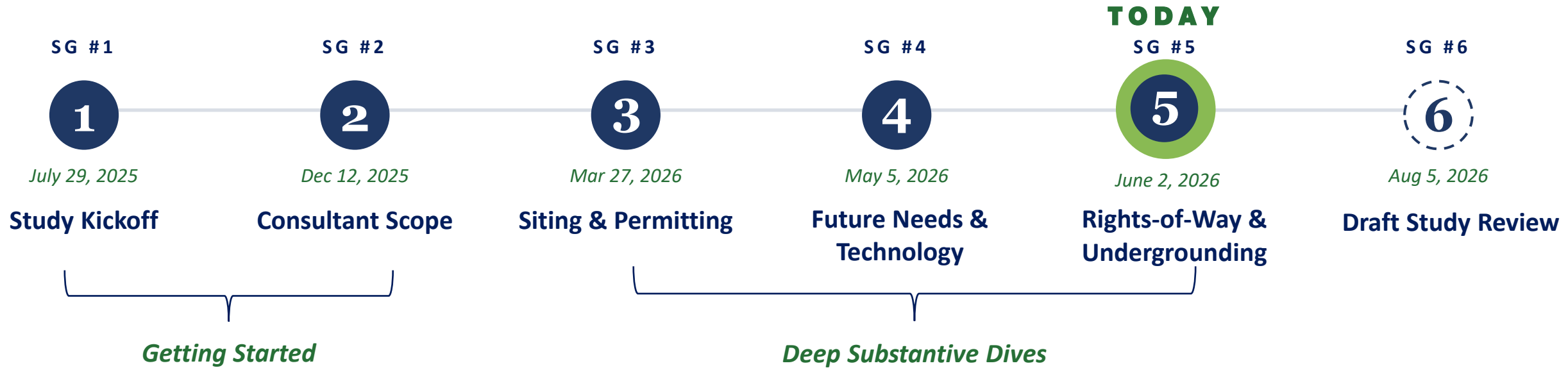


Q&A and Discussion



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Where We Started, Where We Are, What's Next



ENGAGEMENT AHEAD

Please send any remaining thoughts or responses from the Stakeholder Group meetings to doer@maine.gov.

* due June 16, 2026

DOER is exploring how to apply engagement best practice in Maine. More details to come!



Help Shape the Next Energy Plan



maine.gov/energy/plan

- [Request a meeting](#) or a presentation with DOER staff
- [Sign up for email updates](#) to stay informed about the 2027 Energy Plan
- [Share your feedback](#) using the [online survey](#)



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Thank You

doer@maine.gov

www.maine.gov/energy

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Sources (1/3)

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